POINT PAPER

David L. Spelce, MS, CIH
NAVENVIRHLTHCEN
24 February 1998

NEW OSHA RESPIRATOR STANDARD

BACKGROUND:

On 8 January, 1998 the final OSHA Respirator Standard, 29 CFR 1910.134, was published in the Federal Register and has an effective date of 8 April, 1998. Although this new standard contains the same basic concepts as those set forth in the previous respirator standard, there are some significant differences between the new and old standards. In addition, many other OSHA standards involving the use of respirators are affected by this new standard. The following discussion compares and contrasts the new and old respirator standards along with how other OSHA standards are changed by the new standard.

Note: Consult Chapter 15 of OPNAVINST 5100.23 Series for Navy policy on respiratory protection.

DISCUSSION:

Ref: (a) Personal Communication OSHA Ms. D. Collia/NAVENVIRHLTHCEN Mr. D. Spelce of 3 Feb 98
(b) PHONCON OSHA Mr. J. Steelnack/NAVENVIRHLTHCEN Mr. D. Spelce of 29 Jan 98

Introductory Paragraph - In contrast to the old standard, which applied to General Industry (part 1910), the new OSHA Respirator Standard also applies to Shipyards (part 1915), Marine Terminals (part 1917), Longshoring (part 1918), and Construction (part 1926).

Until the final tuberculosis (TB) standard is promulgated, OSHA will continue to enforce respirator usage for TB under the prior unrevised respirator standard, 29 CFR 1910.134, which will be redesignated as 29 CFR 1910.139 when the next edition of the Code of Federal Regulations is published.

Paragraph (a)(1) - The established hierarchy of controls used to protect employees from

hazardous airborne contaminants remains unchanged. Permissible practice remains implementing engineering controls where feasible to protect employees from airborne contaminants prior to using respiratory protection.

Paragraph (a)(2) - As required in the previous standard, respirators are to be provided by the employer, who must establish and implement a complete respiratory protection program. An exception to employers providing respirators is found under paragraph (c)(2), which states that employees are allowed to use their own respirators for voluntary use. This is only when respiratory protection is not required.

Paragraph (a)(3) - This paragraph was deleted from the previous standard. This paragraph previously read "The employee shall use the provided respiratory protection in accordance with instructions and training received". The use of respirators by employees who are required to wear them and by employees who voluntarily wear them is now addressed in paragraph (c).

Paragraph (b) - This new paragraph contains definitions. Most of the definitions were adopted (and sometimes modified for clarity) from ANSI Z88.2, the NIOSH Respirator Decision Logic, and 42 CFR 84. Some of the more note worthy definitions are discussed below:

> The definition of assigned protection factor (APF) is reserved. Paragraph (d)(3)(A) and Table 1 are also reserved for assigned protection factors. In the proposed version of this standard APFs were defined as the APFs in the NIOSH Respirator Decision Logic. OSHA had planned on adopting NIOSH's new APF values once NIOSH published them in the Federal Register. However, OSHA will now develop its own set of assigned protection factors based on a thorough review and analysis of all relevant evidence, including both the NIOSH and the ANSI Z88.2 APFs. Per reference (a), APFs are on the regulatory agenda with a December 1998 deadline and should be published in the Federal Register in Spring of 1999.
>
> Employee exposure is defined as the airborne exposure the employee would have without respiratory protection. The preamble states that this definition is to clarify that employee exposure is to be measured outside of any respiratory protection worn.
>
> Filtering facepiece is defined as a respirator with the entire facepiece consisting of filter medium. Paragraph (c) allows the voluntary use of these respirators when no respiratory protection is required. Under these circumstances, employers need only to comply with paragraph (c)(2), which requires that the employer provide the employee with the information contained in Appendix D "(Non-Mandatory) Information for Employees Using Respirators When Not Required Under the Standard."
>
> High efficiency particulate air (HEPA) filters retain the same filter efficiency as defined in 30 CFR 11 (99.97% efficient against monodispersed particles that are 0.3 microns in diameter). The particulate filters approved under 42 CFR 84 that are equivalent to HEPA

filters are the N100, R100, and P100 filters.

Immediately dangerous to life or health (IDLH) means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

> The preamble states that high concentrations of cadmium fume, which may result in fatal collapse as long as 48-72 hours after an acute overexposure, is considered IDLH even though the effect is not immediate.

Loose-fitting facepiece was first defined in ANSI Z88.2-1992 as a respiratory inlet covering that forms a partial seal with the face. An example is the Racal Airstream Helmet.

Maximum use concentration (MUC) definition is reserved. In the published proposed version of this standard, the MUC was calculated by multiplying the exposure limit by the APF of the class of respirator to be worn. Paragraph (d)(3)(B) is also reserved for MUC.

Oxygen deficient atmosphere is an atmosphere having an oxygen content less than 19.5% by volume (see discussion under paragraph (d)(2)(iii)).

Physician or other licensed health care professional (PLHCP) is defined as an individual who is legally permitted by license registration, or certification to independently provide, or be delegated the responsibility to perform the respirator physicals according to paragraph (e).

User seal check is the new term for positive and negative fit checks. This term was first coined by the ANSI Z88.2 Subcommittee because the term "fit check" was incorrectly mistaken to be an alternative for "fit test" by some individuals.

Paragraph (c) - As under the previous standard, written procedures covering all aspects of the respirator program are required. However, the old term “written standard operating procedures” is no longer used. The respirator program now requires written “worksite-specific procedures,” which cover all elements of the respirator program at actual worksites. The preamble states that workplaces differ substantially and that each program must be tailored to the specific conditions of the workplace if it is to protect employee health. Developing a written program is the most efficient way of ensuring that the program reflects the unique characteristics of each workplace.

Paragraph (c) continued - Unlike the previous standard, the respiratory protection program must be run by a program administrator. The program administrator may delegate responsibilities to

other individuals and serve largely in an oversight role between various individuals performing duties in support of the respiratory program. However, the overall responsibility and coordination

of the program belongs with the program administrator. The program administrator must be suitably trained and qualified to evaluate the program effectiveness (Please see paragraph (c)(3) of the final standard.) The preamble states that the level of training appropriate for a workplace with limited respirator use would be quite different from another with extensive use of different respirator types. The level of training of the program administrator must be adequate to deal with the complexity of the respirator program.

> In the second week of April 1998, copies of "The Small Entity Compliance Guide" will be available from OSHA publication Office (Phone (202) 219-4667). This guide will contain criteria for the selection of a program administrator and a sample respirator program.

Paragraph (c)(1) - The elements of the respirator program are basically the same as before with the following exceptions:

> The requirement for a written respirator program is stronger in the new standard where respirators are required to protect the health of the workers. The new standard requires that employers establish and implement a written respiratory protection program with worksite-specific procedures. There is a new requirement to update the written procedures as necessary to reflect changes in workplace conditions that affect respirator use.
>
> Paragraph (c)(1)(iii) - Requires fit testing "tight-fitting" respirators (See paragraph (f) and Appendix A.)
>
> Paragraph (c)(1)(iv) - Requires procedures for proper use of respirators in routine and reasonably foreseeable emergency situations (See paragraph (g).)
>
> Paragraph (c)(1)(v) - This paragraph not only requires procedures for cleaning, disinfecting, discarding, and other maintenance but also includes schedules for performing cleaning procedures (See paragraph (h) and Appendix B-2.)
>
> Paragraph (c)(1)(vi) - Requires procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators (See paragraph (i).)

Paragraph (c)(2) - Volunteer use respirators are discussed in this paragraph. There are fewer program requirements when respirators are worn when they are not required. The new standard allows employees to wear their own respirators for voluntary use. However, use of these personally-owned or employer-issued volunteer use respirators must not in themselves create a hazard. The preamble warns that use of respirators may present a health hazard to employees who are not medically able to wear them, who do not have adequate information on how to use and care for respirators properly, and who do not understand the limitations of respirators. Therefore, employers must determine that employees who voluntarily wear respirators are medically able to do so, and that there are no other conditions that could cause the respirator use

to create a hazard. The respirators must also be properly cleaned, maintained, and stored. Volunteer use respirators that are worn when they are not necessary to control employee exposure are not required to be fit tested.

There is no written respirator program required for the voluntary use of filtering facepieces. According to the preamble, there are no medical limitations on the use of filtering facepieces. Employers who allow their voluntary use need only ensure that the masks are not dirty or contaminated, that their use does not interfere with employees' ability to work safely, and that they provide the employees with the information contained in Appendix D, "(Non-Mandatory) Information for Employees Using Respirators When Not Required Under the Standard."

According to reference (b), OSHA is not requiring personnel who voluntarily wear respirators to be clean shaven. However, individual corporations may require this to avert union problems (i.e., personnel who must wear respirators becoming upset because they must be clean shaven while volunteer respirator users are allowed to wear beards).

Paragraph (d)(1)(ii) - NIOSH approved respirators will be used in compliance with the conditions of the respirators' certifications.

Paragraph (d)(1)(iii) - Employers will evaluate employee exposure. When employee exposure is unknown, the employer shall consider the atmosphere IDLH.

Paragraph (d)(1)(iv) - The employer shall select respirators from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

Paragraph (d)(2) - The only two classes of respirators that can be worn into IDLH atmospheres are either: (1) a NIOSH approved full face pressure demand self-contained breathing apparatus (SCBA) rated for at least 30 minutes or (2) a combination full face pressure demand supplied-air respirator with auxiliary self-contained air supply. This is in contrast to the previous standard, which according to paragraph 1910.134(e)(3)(ii), hose masks with blowers were allowed to be worn into atmospheres that are IDLH. Hose masks with blowers lost their approval for entry into IDLH atmospheres on 30 December 1977 (Code of Federal Regulations, Title 30 Part 11. 1977 p. 65167-65168).

Paragraph (d)(2)(ii) - Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

Paragraph (d)(2)(iii) - All oxygen-deficient atmospheres (less than 19.5% O_2 by volume) shall be considered IDLH. The respirators specified in Paragraph (d)(2)(i) must be worn in oxygen-deficient atmospheres.

There is an exception when the employer demonstrates that, under all foreseeable conditions, the oxygen concentration can be maintained within the ranges at the altitudes specified in Table II (below) then any atmosphere-supplying respirator may be used.

Table II

Altitude (ft.)	Oxygen deficient Atmospheres (% 0_2) for which the employer may rely on atmosphere-supplying respirators
Less than 3,001	16.0-19.5
3,001-4,000	16.4-19.5
4,001-5,000	17.1-19.5
5,001-6,000	17.8-19.5
6,001-7,000	18.5-19.5
7,001-8,000	19.3-19.5.

The preamble states that the oxygen deficient IDLH concentration is based on the ANSI Z88.2-1980 calculation that takes altitude into consideration. ANSI Z88.2-1980 defines oxygen deficient IDLH atmospheres as having an oxygen partial pressure of 100 mm Hg or less in the freshly inspired air in the upper portion of the lungs, which is saturated with water vapor.

The exception does not apply above 8,000 feet because ANSI Z88.2-1980 oxygen deficient IDLH atmospheres exist when the oxygen levels are 19.5% by volume at these higher altitudes. According to the ANSI Z88.2-1980 calculation, the partial pressure of oxygen continues to decrease with increasing altitude and as shown below at 14,000 feet the partial pressure of oxygen in the lungs is a dangerously low 78 mm Hg.

Partial Pressure of 19.5% Oxygen in the Lungs at Increasing Altitude

Altitude	Atmospheric Pressure mm Hg	Partial pressure of 19.5% oxygen in the freshly inspired air in the upper portion of the lungs, which is saturated with water vapor (atmospheric pressure in mm Hg - 47 mm Hg) (decimal fraction O_2)
9,000 feet	543	97 mm Hg
10,000 feet	523	93 mm Hg
11,000 feet	503	89 mm Hg
12,000 feet	484	85 mm Hg
13,000 feet	465	82 mm Hg
14,000 feet	447	78 mm Hg

Another way to look at this issue is that above 8,000 feet ANSI Z88.2-1980 oxygen deficient IDLH atmospheres exist when the oxygen levels are above 19.5% by volume at these higher altitudes. According to the ANSI Z88.2-1980 calculation, IDLH atmospheres exist at much higher oxygen concentrations as shown below:

Percent Oxygen Below Which An Oxygen Deficient IDLH Atmosphere Exists According to the 100 mm Hg, ANSI Z88.2-1980 Definition of Oxygen Deficiency IDLH		
Altitude	Atmospheric Pressure mm Hg	Percent oxygen required to keep the atmosphere above an oxygen deficient IDLH level [100 mm Hg/(atmospheric pressure in mm Hg - 47 mmHg)]100
9,000 feet	543	20%
10,000 feet	523	21%
11,000 feet	503	22%
12,000 feet	484	23%
13,000 feet	465	24%
14,000 feet	447	25%

The footnote to Table II of the final standard states that above 14,000 feet oxygen-enriched breathing air is required. In contrast, Table 2 of ANSI Z88.2-1992 states that oxygen-enriched breathing air is required at altitudes above 10,000 feet.

Paragraph (d)(3)(iii) - Reliance on odor thresholds and other warning properties is no longer permitted as the sole basis for determining that an air-purifying respirator will afford adequate protection against exposure to gas and vapor contaminants. Employers are required to implement a change schedule for chemical canisters and cartridges based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. This data along with the logic for relying on this change schedule must be described in the respirator program. The basis for cartridge change schedules should ideally be based on tests of cartridge/canister breakthrough studies that are conducted under worst-case conditions of contaminant concentration, humidity, temperature and air flow rate through the filter element. Such information may be based on reliable use recommendations from employers' respirator and/or chemical suppliers. Alternatively, either atmosphere-supplying respirators, or, where they are available and appropriate for the workplace, air-purifying respirators equipped with end-of-service-life indicators (ESLIs) can be worn as protection against gases and vapors.

Paragraph (d)(3)(iv) - The respirators required for protection against particles with mass median aerodynamic diameters (MMAD) less than 2 micrometers are either air-purifying respirators equipped with HEPA filters certified by NIOSH under 30 CFR part 11, or air-purifying respirators equipped with filters certified for particulates by NIOSH under 42 CFR part 84. Alternatively, atmosphere-supplying respirator can be worn.

For contaminants consisting primarily of particles with MMAD of 2 micrometers or greater, an air-purifying respirator equipped with any filter certified for particulates by NIOSH can be worn.

> Note: All particulate filters tested under 42 CFR 84 and HEPA filters tested under 30 CFR 11 are tested against 0.3 micrometer challenge agents. The 0.3 micrometer diameter particles are the most penetrating particle size. Particles larger than 0.3 micrometers are filtered out through impaction and interception while particles smaller than 0.3 micrometers are removed by diffusion.

Paragraph (e)(1) - Medical evaluations are required prior to fit testing and wearing respirators in the workplace. Medical evaluations can be discontinued when employees are no longer required to wear respirators.

Paragraph (e)(2) - Medical evaluations initially involve the PLHCP evaluating information completed by employees in Sections 1 and 2 of the questionnaire in Part A of Appendix C. Questions 1 through 8 in Section 2, must be completed by all personnel required to wear respirators. In addition to these questions, personnel required to wear full face respirators and SCBAs must also answer questions 10 through 15. Questions in Part B of Appendix C can be added at the discretion of the PLHCP. Follow-up medical examinations are scheduled for employees who give positive responses on the questionnaire. Follow-up medical examinations consist of any medical tests, consultations, or diagnostic procedures that the PLHCP deems

necessary to make a final medical determination of an employee's physical ability to wear respiratory protection.

The preamble states that employers are free to provide respirator users with a medical examination in lieu of the medical questionnaire if they choose to do so, but they are not required by the standard (See paragraph (e)(2) of the final standard.) The preamble defines medical evaluation and medical examination as follows:

> "Medical evaluation" means the use of subjective (e.g., medical questionnaires) or objective methods (e.g., medical examinations), as well as other available medical, occupational, and respirator information, to make a determination or recommendation about an employee's medical ability to use respirators.
>
> "Medical examination" means the use of objective methods (i.e., manipulative, physiological, biochemical, or psychological devices, techniques, or procedures) to directly assess the employee's physical and mental status for the purpose of making a recommendation regarding the employee's medical ability to use the respirator.

Paragraph (e)(5)(i) - The PLHCP must be provided with the following information regarding the operation and the respirator which will be worn:

> (A) The type and weight of the respirator to be used by the employee;
>
> (B) The duration and frequency of respirator use (including use for rescue and escape);
>
> (C) The expected physical work effort;
>
> (D) Additional protective clothing and equipment to be worn; and
>
> (E) Temperature and humidity extremes that may be encountered.
>
> (e)(5)(iii) The employer shall provide the PLHCP with a copy of the written respiratory protection program and a copy of 29 CFR 1910.134.

Paragraph (e)(6) - The PLHCP shall provide the employer a written recommendation regarding the following: (1) whether or not the employee is medically able to use a respirator; (2) any limitations on respirator use related to the medical condition of the employee; (3) any limitations on respirator use relating to the workplace conditions in which the respirator will be used; (4) any follow-up medical evaluations that are required; and (5) a statement that the employee was provided with a copy of the PLHCP's written recommendation.

Paragraph (e)(6)(i)(B) - The final standard does not provide for periodic (such as annual) medical

evaluations. The preamble states that it is therefore important that the PLHCP specify whether an employee requires periodic follow-up medical evaluations.

Paragraph (e)(6)(ii) - The employer must provide employees powered-air purifying respirators (PAPRs) in lieu of negative pressure respirators if the PLHCP finds a medical reason that employees cannot wear negative pressure respirators but are medically able to wear PAPRs. If the PLHCP later finds that employees are medically capable of wearing negative pressure respirators, then the employer is no longer obligated to provide PAPRs.

Paragraph (e)(7) - If employee or workplace conditions change to adversely affect an employee's ability to wear the selected respirators, then additional medical evaluations must be performed. Paragraph (k)(1)(vi) requires employees to be trained how to recognize signs and symptoms that may limit or prevent their effective use of respirators.

Paragraphs (f)(1) and (f)(2) - All personnel wearing tight-fitting facepieces must be either qualitatively or quantitatively fit tested initially and at least annually with the same make and model of respirators that they wear. The preamble states that “fit testing not only determines whether a facepiece seal is adequate; it also provides an opportunity to check that fit is acceptable, permits the employee to reduce unnecessary discomfort and irritation by selecting a more comfortable respirator, and reinforces respirator training by providing users with a hands-on review of the proper methods of donning and wearing the respirator." Also retesting facepiece fit solely on the basis of observing physical changes in individual respirator users as suggested in the proposed Tuberculosis Standard would not be a reliable substitute for fit testing on an annual basis. The preamble states that “Individuals with poorly fitting respirators were often detected only through fit testing, and not by other methods such as observation of changes in facepiece fit, failure to pass a user seal check, or an employee reporting problems with the fit of the respirator."

Paragraphs (f)(3) and (f)(4) - If the program manager or the employee observe or perceive reasons that the fit of the assigned respirator is unacceptable, then the employee will be allowed to select a different respirator and be re-fit tested. The preamble explains that physiological changes that affect facepiece fit can occur gradually over time and are easily overlooked by observers, and by the users themselves and that is why annual fit testing is necessary. However, if observed changes in an employee’s physical condition indicate the need for retesting then an additional fit testing is performed.

Paragraphs (f)(5) and (f)(7) - Comprehensive fit testing protocols are provided in the new standard. By contrast, paragraph (e)(5) in the previous standard stated that “Training shall provide the men an opportunity to handle the respirator, have it fitted properly, test its face-piece-to-face seal, wear it in normal air for a long familiarity period, and finally, to wear it in a test atmosphere.”

Fit testing must be performed according to one of the fit testing protocols in Appendix A. Qualitative protocols include: Isoamyl Acetate, Saccharin Solution Aerosol, Bitrex™

(Denatonium Benzoate) Solution Aerosol, and Irritant Smoke. With the exception of Bitrex™, the qualitative tests were modified from the lead standard. Quantitative fit test protocols include: aerosol-generated forward light scattering photometry, ambient aerosol condensation nuclei counter (Portacount™), and controlled negative pressure (Dynatech Nevada FitTester 3000™). Quantitative fit tests must be passed with a fit factor of 100 for tight-fitting half mask respirators and 500 for tight-fitting full face respirators. The preamble states that both half mask and full face air-purifying respirators share the safety factor of 10. Although this standard did not publish APFs, the safety factor of 10 effectively assigns APFs of 10 and 50 to half mask and full face air-purifying respirators, respectively. The protection factors of 10 and 50 equate to 10 and 2 percent leakage or penetration of airborne contaminant into the facepieces, respectively. Successfully fit tested positive pressure respirators can be used in atmospheres up to the APF of their respirator class (See Chapter 15 of OPNAVINST 5100.23 series for a listing of Navy adopted APFs.)

Provision A.14 of Appendix A - The test exercise duration is one minute for each fit test protocol. The exercise sequence is normal breathing; deep breathing; turning the head side to side; moving the head up and down; talking; grimacing (grimace lasts for only 15 seconds); bending over (or jogging in place if the test unit is not large enough for the test subject to bend at the waist); and normal breathing. The grimace exercise is only used for quantitative fit testing because it is designed to break the seal and determine if the respirator can reseal itself. In qualitative fit testing, the test is failed if the wearer detects the challenge agent, therefore the grimace exercise could not be used. In addition, the grimace exercise could cause sensory fatigue that would invalidate the results of any remaining fit test exercises. The results from the grimace exercise are not to be used in calculating the fit factor for quantitative fit testing because breaking the seal lowers the overall fit factor. During the controlled negative pressure fit testing protocol, the measurements are taken after the exercises are performed.

Provisions B.1(a), B.1(b), C.1.(a), and C.1(b) of Appendix A - Qualifications for fit test operators include the ability to: (1) perform the fit tests correctly; (2) recognize invalid tests; (3) ensure qualitative test equipment is properly maintained to ensure proper performance; (4) ensure that the quantitative fit test equipment is cleaned, maintained and calibrated according to manufacturer's instructions so that it will operate as designed; (5) calculate fit factors; (6) clean and inspect test respirators (Fit test respirators must be cleaned after each use and inspected before each use.); and (7) recognize properly conducted user seal checks.

Provision B.2(a)(4) of Appendix A - In the isoamyl acetate protocol (IAA), the ventilation requirements between the odor screening and fit testing rooms have been changed from the lead standard, which required separate ventilation systems in addition to separate rooms. The new language is performance based. The new protocol still requires that separate rooms be used for odor screening and fit testing but there is no requirement for separate ventilation systems. However, the rooms must be ventilated sufficiently to ensure that there is no detectable odor of IAA prior to either a screening test or a fit test.

Provision B.2(b)(5) of Appendix A - The IAA fit test atmosphere can now be generated using a swab or ampule as long as the employer demonstrates that these methods generate a test atmosphere concentration comparable to that generated by the IAA towel-saturation method. The preamble states that the employer may rely on data obtained from the manufacturer of the swabs or ampules as long as the employer uses the products in a way that reproduces the concentrations obtained by the manufacturer under the manufacturer's test conditions.

Provision B.5 of Appendix A - Although there was much controversy over the high levels of hydrogen chloride capable of being produced by the irritant smoke protocol, it remains as an OSHA accepted fit test method. Some new specifications and modifications of the protocol include the following:

The procedure cannot be performed inside an enclosure.

Squeeze bulbs can be used instead of low flow pumps to deliver the irritant smoke. Since there are different sized squeeze bulbs the correct number of squeezes per minute must be discharged to ensure delivery of the required 200 milliliters (ml) per minute volume of irritant smoke.

Volume of Bulb (ml)	Squeezes per minute to obtain 200 ml/min
27	8
30	7
39	5
50	4

The broken end of the ventilation tube must be covered with plastic tubing to avoid cutting the person being fit tested.

The requirement to use MSA smoke tubes has been removed.

Provision C of Appendix A - The requirements in previous OSHA chemical specific standards (i.e., Benzene Standard, 29 CFR 1910.1028) for performing three quantitative fit tests has been removed - the new standard requires only one quantitative fit test.

Appendix A Part II describes the testing that new fit test protocols should undergo before being submitted to OSHA for approval.

Paragraph (f)(6) - "QLFT may only be used to fit test negative pressure air-purifying respirators that must achieve a fit factor of 100 or less." This means that negative pressure air-purifying respirators that are qualitatively fit tested can only be worn in atmospheres up to 10 times the exposure limit. Passing a qualitative fit test method is equivalent to achieving a fit factor of 100

by a quantitative fit test method (Half mask respirators must achieve a fit factor of 100 to pass a quantitative fit test.) The fit factor of 100 includes a safety factor of 10 and equates to a protection factor of 10, which is the assigned protection factor for half mask air-purifying respirators. Full face air-purifying respirators can be fit tested qualitatively, however, they cannot be worn in atmospheres with contaminant concentrations greater than 10 times exposure limits. To wear full face air-purifying respirators in atmospheres up to their assigned protection

factor of 50, as required by OSHA asbestos and lead standards, they must be quantitatively fit tested and achieve a fit factor of at least 500, which includes a safety factor of 10.

The preamble explains that OSHA is requiring fit tests for positive pressure respirators because the consequences of facepiece leakage into positive pressure respirators can be extremely serious. Most workplace use of positive pressure atmosphere-supplying respirators occurs in high hazard atmospheres (e.g., fire fighting, emergencies, spills, IDLH conditions, very high exposures, and abrasive blasting), where a high degree of certainty is required that the respirators are maximally effective. Only positive pressure respirators can be worn in IDLH atmospheres and these respirators must be fit tested to minimize leakage so that users consistently achieve the high levels of protection they need. The preamble explains that:

> Positive pressure respirators, like negative pressure respirators, come in a variety of sizes and models, each with its own unique fit characteristics. The only reliable way to choose an adequately fitting facepiece for an individual user from among the different sizes available is by fit testing. The problem of leakage due to poor facepiece fit can be minimized by choosing good fitting facepieces through fit testing for positive pressure respirator users.

The preamble reveals OSHA's concern that employees may believe that they can afford to use less care in using a respirator that appears to be highly protective; they may ignore seal checks and strap tensioning because they are relying on air flow to overcome any leaks. Fit testing demonstrates to employees that positive pressure respirators can leak, and that fit testing provides immediate positive feed back for employees to see if they have properly donned the respirator and if it properly seals to their face.

OSHA explains their stance that positive pressure inside the facepiece is no substitute for fit testing. The preamble states that positive pressure respirators do not always maintain positive pressure inside the facepiece, particularly when facepiece fit is poor and strenuous work is being performed which causes overbreathing of the respirator to occur. The preamble further states that:

> While increased air flow can reduce the number of negative pressure episodes (Ex. 64-94), OSHA does not believe that the realities of respirator usage allow exclusive reliance on this mechanism to substitute for fit testing. Moreover, the air pressure that positive pressure respirators provide inside the facepiece is intended

to overcome the momentary leakage that may occur with a properly fitting facepiece. This positive airflow alone is not an adequate substitute for a properly fitting facepiece, and cannot be relied upon to overcome the leakage that can occur into poorly fitting facepieces.

Paragraph (f)(8) - Tight-fitting positive pressure respirators are fit tested in the negative pressure mode either by converting them to air-purifying respirators with filters or cartridges or using surrogate facepieces with the same sealing surfaces. To perform quantitative fit testing either permanently probe the surrogate facepiece midway between the nose and mouth or use a sampling adapter designed to temporarily provide a means of sampling air from inside the facepiece. Any modifications to the respirator facepiece for fit testing shall be completely removed, and the facepiece restored to NIOSH-approved configuration, before that facepiece can be used in the workplace.

Paragraph (g)(1) - This paragraph sets forth proper respirator use. Paragraph (g)(1) does not allow facial hair that interferes with facepiece seal or with valve function. This paragraph also requires performing user seal checks either according to Appendix B-1 or manufacturers' instructions prior to wearing tight-fitting respirators and to ensure other personal protective equipment does not interfere with the facepiece seal. Provisions A.8 and A.9 of Appendix A restate these policies.

Appendix B-1 states that if the manufacturer's recommended user seal check procedures are used then the employer must demonstrate that the manufacturer's procedures are equally effective. In the preamble, OSHA states that there are respirators that user seal checks cannot be performed on and that these respirators cannot be used.

The new standard conspicuously does not address the use of contact lenses. Both hard and soft contact lenses are now permitted to be worn with all respirators.

Paragraph (g)(2) - Employee exposure, including stress must be evaluated. The workplace must be reevaluated when changes occur in the operations. Employees are allowed to leave the workplace to change cartridges or filters, to wash their face and facepiece, and to have their respirators repaired if necessary.

Paragraph (g)(3) - Procedures for IDLH atmospheres require one or more employee, as needed, to be posted outside the IDLH atmosphere where they: (1) maintain communication (visual, voice, or signal line) with the employee(s) inside the IDLH atmosphere; (2) must be trained and equipped to provide effective emergency rescue; (3) are equipped with the IDLH atmosphere entry respirators specified in paragraph (d)(2); and (4) are equipped with means for rescue, which could include appropriate retrieval equipment for removing the employee(s) who enter(s) IDLH atmospheres.

Paragraph (g)(3)(iv) - This requires the rescue personnel stationed outside to notify the employer

prior to their entry into the IDLH atmosphere. The employer will have determined in advance in the written worksite-specific procedure who will respond (i.e., local fire department or emergency rescue personnel) to such emergency rescue situations.

Paragraph (g)(4) - For interior structural firefighting, at least two employees must enter the IDLH atmosphere wearing SCBAs and remain in visual or voice contact with one another at all times.

At least two employees wearing SCBAs must be located outside the IDLH atmosphere of the interior structural fire.

Note 1 to paragraph (g): states that "One of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident."

Note 2 to paragraph (g) states that: "Nothing in this section is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled."

Paragraph (h)(1) - The maintenance and care provisions are essentially unchanged (with the exception of the cleaning and disinfecting provisions) from paragraph (f) of OSHA's prior respiratory protection standard. The employer shall provide each respirator user with a respirator that is clean, sanitary, and in good working order. Respirators are cleaned and disinfected using the procedures in Appendix B-2, or procedures recommended by the respirator manufacturer, provided that such procedures are of equivalent effectiveness. Respirators shall be cleaned and disinfected at the following intervals:

> Respirators issued for the exclusive use of an employee shall be cleaned and disinfected as often as necessary to be maintained in a sanitary condition.
>
> Respirators issued to more than one employee shall be cleaned and disinfected before being worn by different individuals.
>
> Respirators maintained for emergency use shall be cleaned and disinfected after each use.
>
> Respirators used in fit testing and training shall be cleaned and disinfected after each use.

Paragraph (h)(2) - Under the heading of storage in the previous standard, OSHA required that respirators be properly maintained to retain their original effectiveness. The current standard requires all respirators to be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals. Respirators must be packed or stored to prevent deformation of the facepiece and exhalation valve.

Paragraph (h)(2)(ii) - In addition to the requirements of the above paragraph, emergency

respirators must be stored according to manufacturer instructions in compartments or in covers that are clearly marked as containing emergency respirators in locations accessible to the work area.

Paragraph (h)(3) - Inspect all routine use respirators before each use and during cleaning. Inspect emergency use respirators for proper function before and after each use and at least monthly according to manufacturers' recommendations. The preamble states that examining emergency respirator performance before and after each use is not intended to be as extensive and thorough a process as the monthly inspection, but includes a basic examination conducted prior to each use to assure the wearer that the respirator which they are about to don in an emergency situation will work properly (e.g., that the cylinders on the SCBA are charged, that air is available and flowing).

SCBA compressed breathing gas cylinders must remain in a fully charged state and must be recharged when the pressure falls to 90% of the manufacturer's recommended pressure level. The regulator and warning devices must function properly.

The preamble states that emergency escape respirators such as mouthpiece respirators, usually stored in the box or bag they come in, do not need to be inspected monthly. However, this type of emergency escape-only respirators shall be inspected before being carried into the workplace for use. Per reference (b), emergency use respirators, such as atmosphere supplying escape only respirators, that are stored in the worksite must be inspected monthly according to manufacturers' instructions.

Paragraph (h)(3)(ii)(A) - This paragraph lists items to be inspected on respirators.

Paragraph (h)(3)(iv) - The monthly inspections for emergency use respirators shall be documented. The inspection information includes the identification of the respirator (i.e., serial number), date of inspection, name of inspector, inspection findings and any remedial action. This information is kept either on a tag or label attached to the respirator storage compartment, or included as written or electronically filed reports. This information shall be maintained until replaced following a subsequent certification. According to reference (b), only the current inspection record legally needs to be kept to cut down on the paperwork burden, however, the program administrator can choose to retain a history of inspections, which would be the most prudent approach for properly maintaining emergency respirators.

Paragraph (h)(4) - Respirators failing inspection are removed from service and are either discarded or repaired by trained personnel using the respirator manufacturer's NIOSH-approved parts designed for the respirator and according to the manufacturer's recommendations. As required under the previous standard, reducing and admission valves, regulators, and alarms shall be adjusted or repaired only by the manufacturer or a technician trained by the manufacturer. Alarms are new items on this special repair list.

Paragraph (i) - As required in the previous standard, compressed and liquid oxygen shall meet the United States Pharmacopoeia requirements for medical or breathing oxygen; and compressed breathing air shall meet at least the requirements for Type 1-Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1. Although the new standard sites the 1989 edition of G-7.1, it retains the artifact of "Type 1-Grade D breathing air." The "Type 1" designation is a remnant from the 1973 edition of G-7.1 and was removed in the 1989 edition. The actual current designation for minimally acceptable breathing air is Grade D."

The previous standard required that "Oxygen must never be used with air line respirators." Similarly, the new standard does not allow the use of compressed oxygen in atmosphere-supplying respirators that have previously used compressed air. This is to prevent a flammability hazard from high pressure oxygen coming in contact with any oil introduced inside the airline hoses from compressed air operations. It further requires that oxygen concentrations greater than 23.5% are used only in equipment designed for oxygen service or distribution.

As in the previous standard, the current standard requires cylinders used to supply breathing air to respirators meet Department of Transportation requirements (49 CFR part 173 and part 178).

The new standard is more stringent in the requirements for cylinders of purchased breathing air and requires a certificate of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air and that the moisture content in the cylinder does not exceed a dew point of -50 degrees F (-45.6 degrees C) at 1 atmosphere pressure to prevent respirator valves from freezing due to excess moisture accumulation. This temperature and pressure equates to 63 ppm v/v moisture content.

Paragraph (i)(5) - As in the previous standard, compressors supplying breathing air to respirators must be constructed and situated so as to prevent entry of contaminated air into the air-supply system. To minimize moisture content, the dew point at 1 atmosphere pressure must be 10 degrees F (5.56 degrees C) below the ambient temperature. This will prevent the moisture in the air from condensing into liquid form. Suitable in-line air-purifying sorbent beds and filters are required to further ensure breathing air quality. Unlike the previous standard, the new standard requires sorbent beds and filters to be maintained and replaced or refurbished periodically following the manufacturer's instructions. This paragraph further states: "Have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change. The tag shall be maintained at the compressor."

Unlike the old standard, the new standard does not require a receiver of sufficient capacity to enable the respirator wearer to escape from a contaminated atmosphere in event of compressor failure. This is because supplied-air respirators are no longer allowed for entry into IDLH atmospheres and therefore do not require a receiver tank that holds enough air to escape on.

Paragraph (i)(6) - The breathing air produced by non-oil-lubricated compressors must not contain

carbon monoxide levels exceeding 10 ppm. This requirement can be met by several different methods (or combination of methods), including the use of continuous carbon monoxide monitor and alarm systems, carbon monoxide filters, proper air intake location in an area free of contaminants, frequent monitoring of air quality, or the use of high-temperature alarms and automatic shutoff devices, as appropriate.

According to reference (b), although ambient air breathing apparatus (AABA) are non-oil-lubricated they do not require carbon monoxide monitors and alarms nor periodic monitoring for air quality. AABA are portable and do require that the air intake is located in an area free of contaminants. It was recommended during reference (b) that permanently installed non-oil-lubricated compressors be equipped with carbon monoxide monitor and alarm systems.

Paragraph (i)(7) - Like the old standard, oil-lubricated compressors must be equipped with high-temperature or carbon monoxide alarms, or both, to monitor carbon monoxide levels. If only high-temperature alarms are used, the air supply shall be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm. High temperature alarms are for the protection of the compressor, while carbon monoxide monitor and alarm systems are for the protection of the worker.

Paragraph (i)(8) - Similar to the previous standard, breathing air couplings must be incompatible with outlets for nonrespirable worksite air or other gas systems and no asphyxiating substance shall be introduced into breathing air lines.

Paragraph (i)(9) - "The employer shall use breathing gas containers marked in accordance with the NIOSH respirator certification standard, 42 CFR part 84." Paragraph 84.81(a) of 42 CFR 84 refers the reader to Department of Transportation requirements. Paragraph 84.81(b) of 42 CFR 84 simply states that compressed breathing gas containers shall be permanently and legibly marked to identify their contents. The previous respirator standard required marking cylinders according to specific ANSI and Federal Specifications.

Paragraph (j) - Unlike the previous standard, which included a color coded chart for identifying respirator cartridges according to ANSI K13.1, the new standard requires markings and color coding according to NIOSH. Paragraph 84.179 of 42 CFR 84 provides labeling information for particulate respirators. This paragraph states that P100 filters shall be color coded magenta but that all other particle filters shall be a color other than magenta. According to paragraph 84.193 of 42 CFR 84, chemical cartridges are still coded according to K13.1-1973.

Paragraph (k) - New respirator training requirements are much more comprehensive than in the last respirator standard. In the new standard, training occurs prior to the employee using a respirator, annually, and when changes in the workplace or change of respirator make training obsolete. Retraining is also required when it is apparent that the employee has not retained the understanding of respirator training or when other situations arise in which retraining appears necessary for the employee to safely use the respirator.

The employer shall ensure that training is conducted in a manner that is understandable to the employee and that each employee can demonstrate knowledge of at least the following aspects of respiratory protection:

Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator;

What the limitations and capabilities of the respirator are;

How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;

How to inspect, put on and remove, use, and check the seals of the respirator;

What the procedures are for maintenance and storage of the respirator;

How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators; and

The general requirements of the respirator standard.

This paragraph also requires employers to provide the basic information on respirators in Appendix D to employees who wear respirators only on a voluntary basis. The training of respirator issuers and supervisors is not addressed in the new standard.

Paragraph (l) - The old standard required regular inspection and evaluation of the respirator program to determine its continued effectiveness. The new standard expounds upon this concept with more specific requirements. The new standard requires evaluations of the workplace as necessary to ensure that the written respiratory protection program is being properly implemented, and to regularly consult with employees to ensure that they are using the respirators properly. Any problems that are identified during this assessment shall be corrected.

Factors to be assessed include, but are not limited to proper respirator selection, respirator fit, proper respirator use, and maintenance.

Paragraph (m) - Retaining records or written information regarding medical evaluations, fit testing, and the respirator program was not addressed in the previous standard. The new standard requires that medical evaluation records be retained and made available in accordance with 29 CFR 1910.1020. Fit testing records of qualitative and quantitative fit tests must include:

The name or identification of the employee tested;

Type of fit test performed;

Specific make, model, style, and size of respirator tested;

Date of test; and

The pass/fail results for qualitative fit tests or the fit factor and strip chart recording or other recording of the test results for quantitative fit tests.

Fit test records shall be retained for respirator users until the next fit test is administered. A written copy of the current respirator program shall be retained by the employer. The written information regarding medical evaluations, fit testing, and the respirator program will facilitate employee involvement in the respirator program, assist the employer in auditing the adequacy of the program, and provide a record for compliance determinations by OSHA.

Paragraph (n) - The effective date of the final OSHA Respirator Standard is 8 April, 1998. The date by which employers must determine that respirator use is required under paragraph (a) is September 8, 1998. Compliance with all other provisions of this standard shall be completed no later than October 5, 1998.

Other Effected Standards - The preamble states that the purpose of revising the respirator-related provisions of OSHA's existing standards was to conform these standards, to the extent possible, to each other and to revised 29 CFR 1910.134 in general. OSHA revised the respirator-approval references in OSHA standards from MSHA/NIOSH, 30 CFR 11, Bureau of Mines, and ANSI Z88.2-1969 to the recently published NIOSH regulation 42 CFR Part 84.

All provisions addressing respirator use, selection, and fit testing were deleted from the substance-specific standards, making these standards consistent with the final respiratory protection standard with respect to these requirements. In the substance-specific standards, the incorporated provisions of revised 29 CFR 1910.134 cover the following requirements:

definitions (paragraph (b));

respiratory protection program (paragraph(c));

selection of respirators (paragraph (d));

Paragraph (d)(1)(iii) of the revised respiratory protection standard, which requires employers to estimate exposure levels in selecting appropriate respirators, has not been incorporated into OSHA's substance-specific standards because they already include exposure assessment provisions that are more specific than the general exposure-assessment requirement in the final respiratory protection standard.

Paragraphs (d)(3)(iii)(B) (1) and (2) of the revised respiratory protection standard, which addresses chemical cartridge change schedules, have not been incorporated into the Vinyl chloride, Benzene, Acrylonitrile, Formaldehyde, and 1,3-Butadiene substance-specific standards because these standards already have change schedules that were especially tailored to the chemistry of the specific substance and their documented exposure conditions requiring these change schedules.

Substance-specific standards retain their own APFs until OSHA establishes APFs in 29 CFR 1910.134.

fit testing (paragraph (f));

OSHA revised the frequency of respirator fit testing from semiannually to annually for the Asbestos (29 CFR 1910.1001 and 1926.1101), Arsenic (29 CFR 1910.1018), Lead (29 CFR 1910.1025 and 1926.62) and Acrylonitrile (29 CFR 1910.1045) standards. The Agency believes that this revision will not diminish the effectiveness of respiratory protection provided by these standards.

use of respirators (paragraph (g));

maintenance and care of respirators (paragraph (h));

breathing air quality and use (paragraph (i));

identification of filters, cartridges, and canisters (paragraph (j));

training and information (paragraph (k));

program evaluation (paragraph (l)); and

recordkeeping (paragraph (m)).

Paragraph (e) of the new respirator standard was not incorporated into the substance specific OSHA standards. Each of the existing substance specific OSHA standards include unique medical evaluation requirements for employees who use respirators. The preamble states that OSHA believes that the medical evaluation requirements for respirator use established under its existing substance specific standards already provide a high degree of medical protection to employees who are required to use respirators to control their exposures to the airborne substances regulated by the substance specific standards. Also, medical evaluation requirements for respirator use in the substance specific standards are part of a comprehensive, integrated medical surveillance program designed to evaluate employees for conditions and risks associated with exposure to the regulated substances. Therefore, OSHA believes that any revision to the frequency or content of medical evaluations for respirator use would unnecessarily disrupt

ongoing medical surveillance programs and, therefore, jeopardize the health of employees who must use respirators to prevent exposure to hazardous workplace substances.

Per reference (b), there were two specific problems with amending the Lead and Asbestos Standards. The final standard stated that no respirators used for protection against lead could be worn for longer than 4.4 hours. The 4.4 hour restriction was originally for air-purifying respirators equipped with HEPA filters due to increased breathing resistance of the HEPA filters.

Reference (b) stated that this provision was mistakenly included in the final respirator standard as a 4.4 hour restriction for all respirators used for lead. Per reference (b), the standard will be revised to totally eliminate reference to the 4.4 hour restriction even for air-purifying respirators equipped with HEPA filters.

The final respirator standard also stated that only combination full face pressure demand supplied-air respirators equipped with auxiliary escape air cylinders could be used for Class I work. Per reference (b), this was also a mistake and that for all Class I work without negative exposure assessment use a full face, pressure-demand supplied air respirator equipped with either an auxiliary self-contained air supply or HEPA egress cartridges. For all Class I work between 0.1 and 1 f/cc as an 8 hour TWA, use a tight-fitting powered air-purifying respirator equipped with high efficiency particulate filters. For Class I work below 0.1 f/cc as an 8 hour TWA, use any respirator approved for asbestos.

The new respirator standard also effects 29 CFR 1910.1003 (the "13 Carcinogens standard"). The provision requiring employers to ensure that employees use respirators in accordance with 29 CFR 1910.134 was amended to require compliance with paragraphs (b), (c), (d) (except (d)(1)(iii), (iv), and (d)(3)), and (e)-(m) of this standard. Paragraph (d)(1)(iii) of the revised respiratory protection standard, which requires employers to estimate exposure levels in selecting appropriate respirators, has not been incorporated into 13 Carcinogens standard. Exposure estimates for the substances regulated by this standard are not necessary for respirator selection because appropriate respirators have been identified for specific work activities that occur during employee exposure to each of the 13 carcinogenic substances.

The respirator requirements applicable to construction work (29 CFR 1926.103) are identical to 29 CFR 1910.134. To implement this action, the title of this section remains, but a Note is added to read:

> "Note: The requirements applicable to construction work under this section are identical to those set forth at 29 CFR 1910.134 of this chapter."

Appendix B of 29 CFR 1926.62 (the Lead standard for Construction) was revised by citing Appendix A of 29 CFR 1910.134 as the reference for fit testing.

Other standards effected include Ventilation (29 CFR 1910.94), Storage and Handling of Anhydrous Ammonia (29 CFR 1910.111), Fire Brigades (29 CFR 1910.156), Pulp, Paper, and Paperboard Mills (29 CFR 1910.261), Ventilation (29 CFR 1926.57), and Underground Construction (29 CFR 1926.800). In these standards definitions and references to

NIOSH/MSHA, 30 CFR 11 and ANSI Z88.2-1969 were updated to coincide with 29 CFR 1910.134.

Neither the new Respirator Standard nor the Fire Brigades Standard (29 CFR 1910.156) state that federal firefighters (including Navy firefighters) must follow 29 CFR 1910.134. However, according to reference (b), federal firefighters must follow 29 CFR 1910.134 because they use respiratory protection.